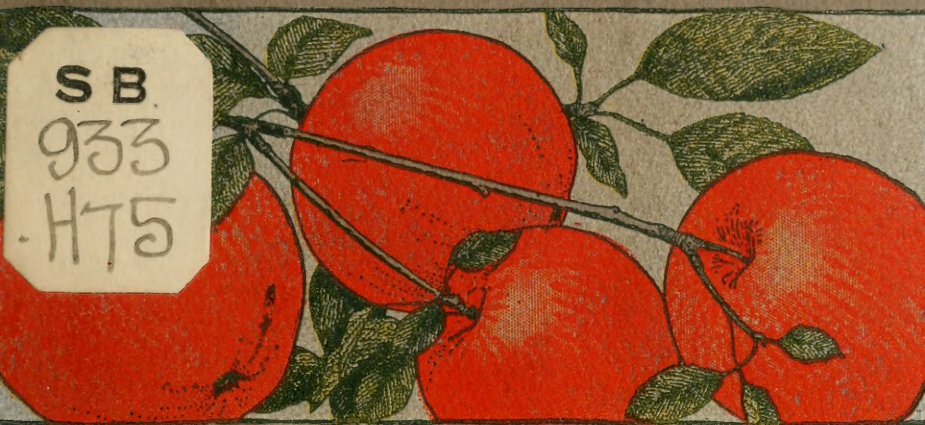


# FIGHTING GARDEN PESTS



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## THE COUNTRYSIDE HANDBOOKS

THE COUNTRYSIDE PRESS  
HARRISBURG, PA.



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**HOW TO FIGHT  
GARDEN PESTS**



THE COUNTRYSIDE PRESS  
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HARRISBURG, PA.





Goat-moth resting on tree trunk (two-thirds natural size). The moth and the gray bark were so alike that the moth had to be outlined. See page 50.



# HOW TO FIGHT GARDEN PESTS

*ILLUSTRATED AND WITH  
SPRAYING TABLES*

HARRISBURG, PA.  
THE COUNTRYSIDE PRESS

1915

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## INTRODUCTION

**T**HERE is need of a handbook which shall deal with garden pests, and the simplest methods of getting rid of them. Much of the material found in the following pages has appeared in magazine form, and is here used by permission of the publishers. Credit is also given to The Deming Co., Salem, Ohio; Barnes Mfg. Co., Mansfield, Ohio, and E. C. Brown Co., Rochester, New York, for the use of illustrations of spraying implements. The reader will find much valuable information condensed in this handbook, and the instructions, if properly followed, will save many times its cost.



## HOW TO FIGHT GARDEN PESTS

**T**HUMBS down! Kill 'em!

In this battle we give no quarter. Prisoners are always slaughtered.

Moreover, the winner must be up early, and must keep at his killing till late in the day. He must push his trade of murder everywhere. He must breathe death on every hand.

The man who has a garden must work for it and sweat for it and fight for it, and if he can't do that, he isn't worthy to have a garden.

Of course, the situation is not so desperate as it seems to the beginner. The well-grounded gardener takes all garden pests very coolly. He is always ready for them, and being ready is more than half the battle. Perhaps the professional gardener might even be disappointed if those annual enemies of his labors did not reappear.

### PREVENTION THE IDEAL WAY

The old proverb about an ounce of prevention being better than a pound of cure is ten times truer in dealing with garden pests than in any other business of life, especially with plant diseases. Most of them never can be cured or hardly alleviated

when once they get a start. Practically all methods of modern scientific treatment are wholly preventive.

Now, the very best preventive of disease is always and everywhere good health. Vigorous, well-kept plants will rarely suffer from severe attacks of disease or even of insect enemies. All the methods of good garden management, therefore, are the chief reliance for warding off garden pests. Good tillage, good drainage, adequate water-supply, proper feeding, generally good sanitary conditions, make up the universal prophylactic.

### BUGS, BEETLES, AND OTHERS

There is no more exasperating trial and tribulation the gardener has to bear than to have a promising crop destroyed by some insect pest. Poor seed is annoying enough; but in that case we lose nothing but anticipations, and the loss can often be made up. Bad weather and drought are to be dreaded; but we put these in the category of natural fatalities over which we have no control. But the insect pest is another matter. When the cutworms nip off your newly set plants or promising seedlings, apparently just for spite, as they make no use of the plants they destroy; or a fat, green cabbage worm eats tracks all over the heart of your biggest and choicest cauliflower; or the gay and heartless little cucumber beetles devastate your carefully planted hills of cucumbers and melons; then it seems as if they were working against you with a



personal and impish animosity, and it's only natural to get mad clear through.

This course, however, is both unreasonable and useless. In the majority of cases it is more your fault than that of the bugs. We now have effective preventives and remedies for the majority of them. The science of warfare against garden pests has developed wonderfully within the last two decades. There are a few which we yet have no easy practical method of fighting; but against most of the garden insects we may go forth to battle with confidence of success—if we select the right weapons.

That is the whole secret of plant protection. It is not so many years ago that that veteran, and by no means pessimistic, plantsman, Peter Henderson, when writing about injurious insects, could say that experience convinced him more and more of the futility of the methods of fighting which then existed. But that condition has changed entirely. The gardener who at the present time feels himself at the mercy of garden pests lays himself open to more than a suspicion that it is because he has been too lazy to keep up with modern methods and discoveries.

### NECESSARY TO DISCRIMINATE

Before you can hope successfully to combat the bugs, you must study them. The first great secret of success in this warfare is to know the enemy—and thereby what to use against him; the second is

to act immediately when you discover or suspect him; the third is to do a thorough job. If you will get these three principles firmly fixed in mind, and act upon them, you will be able to cope with the great majority of garden pests. And you will find it a good deal less work and infinitely less worry than the old haphazard Jones-says-try-this, Smith-recommends-that method of attempting to deal with them.

To the beginner, the situation always looks very complicated and very confusing. There seem to be an innumerable number of bugs, beetles, lice, and other parasites—a couple of general sorts and one particular sort for almost every plant grown. And, where insects are lacking, various and varied diseases are to be encountered. And, in the way of remedies, there are about three humbugs for every bug. But costly experience and the splendid experimental and educational work of the state experiment stations have done much, in recent years, to drive out the more flagrant frauds. With the service and advice of one's state experiment station free for the asking, it is generally your own fault if you allow yourself to be taken in. However, there are a number of standard commercial preparations of most of the materials used in this warfare with garden pests, and, because of their greater convenience in use, and uniformity of strength over home-made preparations, they will continue to be depended upon for the greater part of the ammunition of the small grower and the home gardener.

## TWO KINDS OF INSECTS

Before we take up this question of ammunition in detail, let us go back to the enemy. Try to forget all the names, forms, colors, and appearance of the various bugs and worms you ever heard of, and get them classified in your mind according to their habits, especially the way in which they eat.

The eating and chewing insects—bugs, beetles, and worms—which get their food by chewing parts of the foliage stems or fruit, you should learn to put together in one class. Cabbage worms, potato bugs, currant worms, and others which are similar, belong to this class. As they eat parts of the plants which may be covered with poison, and their food is swallowed in proportionately large amounts, the various internal poisons are effective against them. Of these the best for general use is arsenate of lead. The various forms of this and the other stomach poisons are described in a following paragraph.

The sucking insects—aphides, lice, scales, and the “nymphs” or young of some of the bugs and flies (such, for instance, as the black squash or “stink bug,” and the white fly, which attacks tomatoes, cucumbers, and other plants, especially under glass), live by sucking the plant juices from beneath the skin, so that poisons applied to the foliage and stems of the plants are useless against them. Don’t waste your time trying a poison, just because you may have it on hand or have used it for something else, against members of this class. In their case there are two

different types of "medicine" which are effective. The first is some repellent, something that is extremely disagreeable to Mr. Bug, and will prevail upon him to stay away or to leave for more congenial surroundings. Tobacco dust and other materials described later are good for this purpose. The second class is made up of such things as destroy by *contact*, either smothering or asphyxiating the undesirable citizens to which they are applied, for example, Persian insect powder.

### BAD, BAD BORERS!

In addition to the above two classifications, still a third group is composed of internal feeders, such as maggots and borers. The root-maggot, which attacks cabbage and onions, the squash borer, and wire-worms are examples, all too familiar, of this class. They are by far the most difficult to combat. In the case of the root-maggot, especially, we are still quite helpless, so far as an effective practical remedy is concerned, although much may be done in the way of prevention by clean culture, crop rotation, etc.

So the first step to take in keeping your plants healthy, as from day to day you look over your garden and inspect the condition of your growing crops, is to learn to place each intruder in his proper class. That done, you are on the right track, and you can go after him intelligently, with the weapon most likely to prove fatal in his particular case.



## PLANT DISEASES

Unfortunately, insects are not the only things with which we have to contend. Diseases of plants must be reckoned with, too. These are more insidious and difficult to deal with. As a rule, they must be prevented, or fought in the very first stages of development, if anything is to be accomplished. They also may be separated into two groups—local and constitutional. Most of the garden diseases belong to the latter class, and by the time one discovers their presence it is too late to do anything to save the infested plants. The instructions for fighting plant diseases usually begin with this sentence: "Pull up and destroy at once all affected plants." That is about as cheering to the enthusiastic gardener as it would be to instruct the careful house-wife: "Cremate and bury at a safe distance from the house all patients as soon as convenient!" Fortunately, we now have a fairly effective preventive remedy for the most destructive group of garden diseases—the various forms of blight—in fact, two remedies,—bordeaux mixture and various preparations of sulphur. The various forms of leaf-spot or rust are also held in check by these sprays.

From the foregoing, it becomes evident that our remedies also may be separated into two general groups—preventive measures, and those to be used after the trouble has actually put in an appearance. In the former class belong the regular sprayings which should be done in garden and with fruit trees

regularly every year, such as spraying for the fruit insects which are practically certain to put in an appearance, and for the prevention of blight on potatoes and muskmelons. In addition to these, it is often practicable to give effective mechanical protection, by means of small frames covered with wire or mosquito netting, or by destroying such bugs as appear, by hand-picking or knocking them into a can of kerosene and water, with a small wooden paddle made for the purpose.

### PRAYING AND SPRAYING

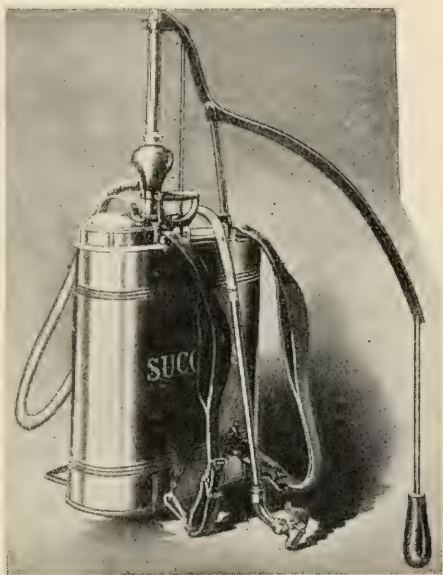
It has come to be the general understanding that all insects, fungi, and other garden troubles are to be met by spraying. This, however, is expecting too much. Human diseases cannot all be prevented, nor even cured, by the use of drugs; and our knowledge of plant pathology, therapeutics, and materia medica has not yet caught up with the regular medical profession. In fact, we aim at prophylaxis oftener than at cure.

Spraying merely frees us for the time being; it does not eradicate the pests entirely. If it did, we shouldn't have any pests, because, no matter how much behind the times a person might be, he would make one supreme effort, and spray, to rid his garden of bugs and disease. We must spray continually, and all our efforts will only keep the insects in check. This can be accomplished best by killing as many of the bugs as possible before they breed.

## SPRAYING MACHINERY

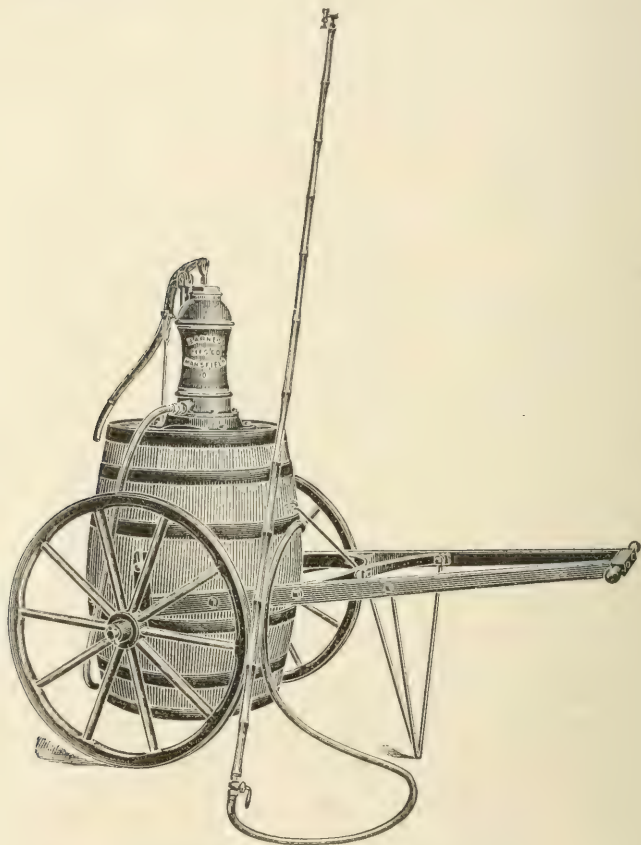
There are many kinds of apparatus for spraying, such as power-sprayers, barrel-pumps, bucket-sprayers, and hand-sprayers, and they usually come fitted with proper nozzles. Where the work must be done by one person, the air-pressure sprayers are the best, as the machine can be charged, and all attention can be directed to the spraying.

Another very good sprayer for the amateur with a small garden is a bucket-spray-pump. These are the cheapest pumps on the market. Some sell for as low as two dollars, but it is poor policy for anyone to buy the cheapest. Pay from four to five dollars, and get a good one, with all the working parts of brass, which, with good care, will last a number of years. This style of sprayer comes with a short hose, which is convenient for spraying low shrubs and vegetables; but, if you have a few trees to spray,



Knapsack-sprayer

it will be necessary to buy an extra 25 feet of hose. To spray the tops of them, tie the nozzle on the end of a rake-handle, and stand on a step-ladder to



Barrel outfit, best for garden use

reach the highest parts. For this work you will need two persons—one to pump, and the other to direct the spray.



### THE KNAPSACK-SPRAYER

Another form of spray-pump is the knapsack-sprayer. The idea of it is very good, but the tanks are never tight, and the motion of walking slops the



A cheaper outfit is the bucket-pump

liquid over the one doing the work. When using one of these, it is necessary to wear a rubber coat.

If you are on friendly terms with your neighbors, and your garden and grounds are not large

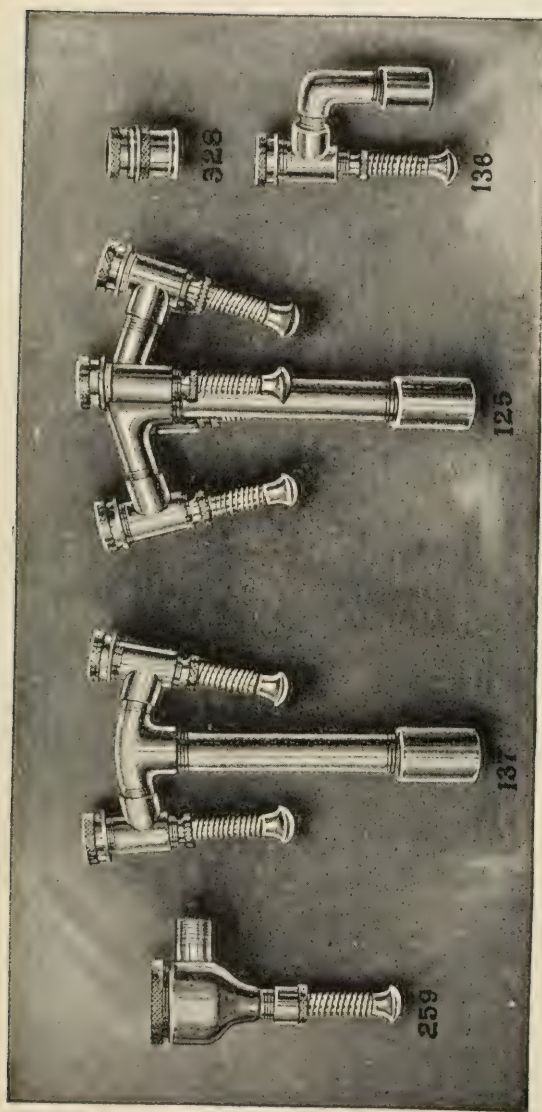
enough to warrant your investing in a sprayer by yourself, why not buy a good barrel-sprayer on shares? This will necessitate your giving each other a hand in the spraying, but the work can be done in much less time, and more effectively.



For the small place a pump fitted to a barrel on wheels is most convenient

No matter what kind of sprayer you have, always clean it thoroughly after using it, as some of the chemicals used in spraying, if allowed to remain in the pump, will destroy it in a short time.

Besides the pumps, there are many other items



Common styles of nozzles

of equipment to be provided. First of all, nozzles. There are two types of these which are especially useful for orchard work. The first is the old bordeaux type which, while it does not make a fine spray, will carry a long distance, and is therefore desirable for reaching the tops of the trees. The second is the large disc type, consisting of a single, large nozzle. This does not clog nor catch in the branches, and it gives a very fine spray.

Good and proper hose will also be required. The principal caution to be given here is to get small hose and plenty of it. Quarter-inch size is the best, where it can be had. To one who has always used the ordinary large-sized hose, spraying is like play when the small hose is secured. The question of buying cheap cotton hose which will last but one season, or the more expensive rubber hose which will last several seasons, is still in debate. The rubber hose is undoubtedly better; but, as some of our spray mixtures are injurious to rubber, it may be that the cotton hose will be cheaper in the long run. The main objection to it is that it cannot be had in small sizes. In any case, get plenty of hose—25 to 50 feet is none too much for orchard work.

### ESSENTIALS OF EQUIPMENT

The bug-fighting outfit for the home garden need not be expensive. The important point is to have the several things on hand, so that they will be available for immediate use at a moment's notice.



Here is a list of the essentials; other things may be added if desired, but the following will be sufficient to take care of most of the plant-trouble problems likely to arise in the home garden and orchard:

A compressed-air sprayer, either tank or knapsack type (the tank is the better)—in either case pay a little more and get a *brass* machine, it will outlast several of the metal ones; a good powder-gun, for dusting or blowing on tobacco dust or other insecticides in powder form. Materials to make, or a small, ready-prepared package of some reliable commercial brand of each of the following: Arsenate of lead, paris green, hellebore, tobacco dust, nicotine extract, kerosene emulsion, bordeaux mixture, and lime-sulphur.

Arsenate of lead is a poison which has, to a very great extent, taken the place of paris green. Its advantages over the latter are that there is no danger of burning the foliage with it, and that it will not wash off in the rain. It may be bought in either paste or powder form, or in two separate powdered ingredients for making it. It is sprayed on in solution according to directions. Some of the powdered forms are suitable for using dry.

### LEADING INSECTICIDES

Paris green is the standard insecticide, used either in solution in water (one pound to fifty gallons, or about a quarter-pound in half a barrel) or dry, mixed with land plaster, or gypsum. Some-



times it is dusted on pure; but this must be done very carefully, and by an experienced gardener, or more injury than benefit is likely to be the result.

Hellebore is not so effective as either of the foregoing, but is used, dusted on dry or sprayed, for a temporary effect, as rains or washing will remove it completely. On currant bushes after the fruit forms, or on cabbage after the heads have begun to mature, it is used in place of paris green or arsenate of lead.

Tobacco dust is a very fine powder, varying greatly in strength. Get some reliable brand, which should cost you, in bulk, around three cents a pound. Dust freely over young plants, and hills of melons and other vine crops, to repel bugs, and on foliage of lettuce and plants, to keep off aphides, etc.

Nicotine, or tobacco extract, is contained in many commercial preparations, in varying strengths. These should always be used carefully according to directions. It is the per cent of nicotine, and not the price per pint, which determines the comparative real cost of these preparations. Many of these preparations are most effective if applied when they will be followed by several hours of bright sunshine.

All tobacco preparations are very good for aphides of all kinds, and, if used as a preventive, will keep your garden free from this pest. These are sold in bottles or cans, with directions for use pasted on them. If these are not available, you can make an infusion of tobacco by soaking some tobacco-stems

for twenty-four hours in warm water. Dilute it so that it looks like weak tea.

### KEROSENE EMULSION

Kerosene emulsion is one of the best sprays to use against aphides of all kinds, and is also very effective against hard-bodied insects. It is easily made at home, the only ingredients being soap, kerosene, and water. To make, dissolve half a pound of soap in a gallon of hot water. When the soap has dissolved, remove the dish containing it from the fire and add two gallons of kerosene; stir it well, so that the kerosene will become well mixed. The best way of mixing is to use a bucket-pump, pumping the emulsion through the pump back into the receptacle holding it.

One can buy kerosene emulsion ready-made; all that is necessary is to add water to it before using. These preparations are very handy for the suburbanite, as they save him a lot of dirty work.

Undoubtedly the amateur, or anyone with only a few trees, had better buy one of the so-called miscible oils for killing the scale; directions for using come with these. They are usually mixed with water at the rate of one to twenty.

Lime-sulphur wash is made as follows: Slake four pounds of stone lime in a kettle on the stove, add three pounds of sulphur, and boil the mixture for one-half or three-quarters of an hour, stirring it all the time. Strain this into a barrel through a fine

wire netting or burlap, and add water to make ten gallons. It is best to make up this solution as wanted, and put it on hot. Smaller quantities can easily be calculated.

### FUNGICIDES OF VALUE

For fungous diseases of all kinds, the best remedy is bordeaux mixture. You can mix it yourself by dissolving five ounces of blue-stone (copper sulphate), with five and one-half ounces of good stone lime, in five gallons of water and stir thoroughly. The blue-stone should be dissolved by placing it in a coarse-meshed bag and suspending it in the vessel containing the water.

Strain the liquid into the sprayer and, if an insecticide is wanted to combine with it, add three to six ounces of arsenate of lead.

The amateur will save time by buying one of the ready-made bordeaux mixtures. There are several good ones on the market which can be bought from reliable seedsmen. To prepare for spraying, all one has to do is to add water according to directions which will be found on the can.

Lime-sulphur, especially in the ready-prepared forms, is coming into use more and more as a substitute for bordeaux. In a stronger form it is also used as a winter spray for San José scale.

A good preparation for mildew is potassium sulphide. Use one-half ounce to one gallon of water. Flowers of sulphur and grape dust dusted on the plants are good, but they blow off.

### COMBINATIONS POSSIBLE

As arsenate of lead and paris green can be used with the bordeaux or lime-sulphur sprays, thus making a combined insecticide and fungicide treatment, many gardeners are finding that the simplest way of keeping plants healthy—vegetables, flowers, roses, and fruits—is to keep a supply of these things constantly on hand, and to spray frequently enough, whenever trouble is anticipated, to keep all new growth covered and protected in advance against the attacks of the various plant enemies. On the small place, with a good hand-sprayer, this is not a difficult task. And still greater aid to the gardener is in sight. Experiments have been in progress, and are now meeting with some success, to produce a combined insecticide and fungicide powder for dry dusting, which will adhere well enough to take the place of the above combination sprays. This will be the easiest and best thing yet.

### INVENTORY OF ENEMIES

One of the most widespread and trying enemies of fruit trees is the San José scale. Carefully examine all your trees at least once a year for this pest. It can be recognized by a blackish scum on the branches, which can be scraped off with the back of a knife.

All kinds of fruit trees are especially liable to this scale, and there is nothing but the evergreens



Twig scatteringly infested with male scurfy scale,  
somewhat enlarged

that seems immune. We must never relax our efforts to keep this pest in check. Spraying the trees in early spring, before growth starts, with the lime-sulphur mixture is very good, but it is very



dirty to apply, as it soils and burns everything with which it comes in contact. There are various crude-oil preparations now on the market which are very



Twig covered with San José scale, the worst enemy of fruit trees

good, but, in order to make them effective, care must be taken that all parts of the tree be thoroughly covered, as they kill the scale by suffocating it. On a



Blossom end of apple thickly infested with young scale, with a few full-grown scales, and showing the purplish discoloration

small place, where only one tree is affected, the best way is to scrub it off with a brush and some good, strong insecticide, like whale-oil soap. After cleaning the scale off, whitewash the tree thoroughly.

Asparagus is troubled sometimes in spring with a cutworm which cuts off the shoots just below the ground. The only remedy for this is to put plenty of air-slaked lime or soot in your ground. During summer the asparagus will sometimes be attacked by a beetle which eats off the outer covering of the stem. This greatly weakens the plants. Spraying with a poison, such as paris green or arsenate of lead, will stop its depredations. Dusting hellebore on the plants in the morning, when the dew is on them, is effective.

Beans are subject to rust. If your beans were troubled with it last season, start spraying early this year with bordeaux mixture, repeating it every two weeks.

### CABBAGE WORMS

The cabbage is subject to several diseases, the most dangerous of which is the club-root, and there is no cure for it. If the plants are attacked when small, pull them up and set out new plants in another place, and cover the infected ground with lime.

For the cabbage worm, use a poison if the plants are small; though, after the cabbage starts to head, this would be dangerous. Use strong tobacco water or kerosene emulsion, or, if you have only a few heads, picking them off will not be a hard task.

Cauliflower is subject to rust, and must be sprayed with bordeaux to ward off an attack.

Celery is very troublesome in the matter of rust, and must be sprayed every two weeks with bor-

deaux mixture or an ammoniacal copper carbonate solution. Do not wait for the rust to appear, but start using bordeaux mixture as a preventive, and you will probably never see the rust.

Blight and mildew attack cucumbers, doing serious damage. Spraying every two weeks with bordeaux mixture will prevent an attack. If the cucumbers are sprayed when small, much damage from the flea beetle can be prevented.

Lettuce and, in fact, nearly all the vegetables, when small, are troubled more or less with green or black fly, mealy bug, etc. For all these pests, use a tobacco dust or water, or kerosene emulsion.

There is a fungus disease which attacks strawberries, making purplish or reddish brown spots. Spraying with bordeaux mixture will prevent this.

For mildew on gooseberries, currants, and grapes, use potassium sulphide. For worms on gooseberries and currants, use paris green or arsenate of lead when the berries are very small, but, after they have attained any size, knock the bugs off with a good, strong stream of water, and sprinkle them, when on the ground, with lime or tobacco dust.

### TREATING FRUIT TREES

Apples, pears, peaches, plums, and cherries require almost the same treatment. When the blossoms are about to open, spray the trees with bordeaux mixture which contains paris green or arsenate of lead, to kill the bud moth. After the

blossoms have fallen, spray again with the same mixture. Spray every two weeks all summer long with bordeaux mixture, for there seems to be a succession of diseases attacking the trees, especially the apple, which has scab, rust, and bitter-rot to contend with.

Hardy shrubs and trees are troubled with leaf-eaters of different kinds; for these, spray with a poison. For aphides on the tips of the young growth, use tobacco water or kerosene emulsion.

Do not do any spraying for the rose bug, as it is useless. The only remedy for this pest is hand-picking, throwing the bugs into a pail in which there is some kerosene.

Melons require spraying with bordeaux mixture at least once every two weeks. A number of folk say, "My melons looked so fine until the fruit was nearly ripe, then the leaves seemed to curl up and turn brown, and the plants died." To prevent this, start spraying when the plants have only four or five leaves, and repeat it every ten to fourteen days, so that the plants will be completely covered with the bordeaux mixture.

The best way to combat the potato beetle is by spraying with a strong poison—paris green or arsenate of lead. This is best applied by mixing it with bordeaux mixture, as potatoes must be sprayed every two weeks with bordeaux mixture to prevent blight. The bordeaux mixture alone drives away many insects.

Even the tomato plants will make a healthier



growth if they are sprayed a few times with bordeaux mixture.

Onions, radishes, and various other crops are more or less troubled with maggots. To prevent damage from these, make a liberal application of soot or air-slaked lime to the soil, working it in an inch or two deep with a wheel hoe. Lime can be used quite freely—a heaping shovelful to a square yard of earth—and it is best applied in the late fall and left all winter. Although it is a little more expensive, soft-coal soot is especially good for quick effect. It is best applied while the crop is growing.

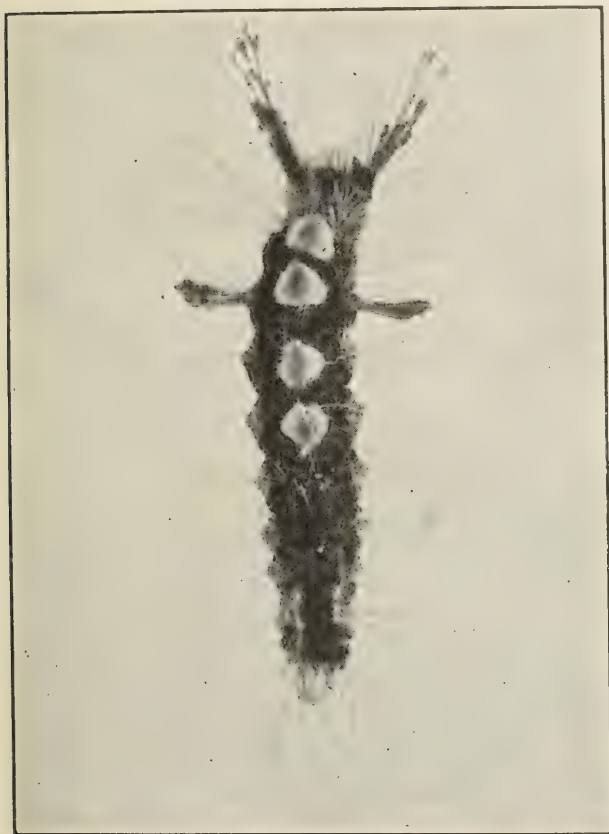
### THE PLAGUE OF ANTS

Ants sometimes congregate in such numbers as to make themselves a nuisance. There are several ant remedies on the market, but there is a home-made one which is much the best.

Cut up some fresh meat in squares and place it near the ant-holes. Come around in about an hour, and you will find the meat covered with thousands of ants. Stick a meat skewer or sharp stick in the meat, and knock it over the side of a pail with some kerosene in the bottom. It is surprising the number of ants that can be caught.

Annual flowering plants of all kinds are very often attacked by aphides; for these use tobacco water or kerosene emulsion.

Poisons for chewing or eating insects are best applied with a fungicide, as it saves time.



Rusty tussock moth caterpillar. Look for the eggs in February and March

### SPECIAL OUTBREAKS

About once in every little while there is a big outbreak of some new and vicious insect, or some unheard-of disease. Sometimes these are temporary in their effects; sometimes they come to stay. Take,

for example, the bagworm which was so bad in many parts of the country three or four years ago. The bagworm is a common parasite that is found in New York State, and most of the states south of this point. Dr. L. O. Howard states that the bagworm, like the tussock moth and the fall webworm, is preëminently a pest on the streets and in parks and private grounds of cities and towns, and that it is even more subject to fluctuation in numbers. In the year 1907, the bagworm caused more annoyance than any other tree-defoliator. It seems that its natural enemy, a species of the Ichneumon fly, was comparatively scarce, and the result was that the bagworm multiplied rapidly, and became a pest throughout many states. During that year, the Bureau of Entomology received numerous complaints of injuries in the region of New Jersey, Pennsylvania, Maryland, Virginia, West Virginia, Ohio, Indiana, and Illinois.

In certain localities in New York, New Jersey, and North Carolina, the bagworms sustain strong colonies year after year. While visiting in Asheville, North Carolina, the writer discovered that many of the pine trees in that city were infested with bagworms. When numerous, these caterpillars are most destructive to pine trees, and, in fact, to all evergreen trees. They have been known to kill a pine tree in a single season. A pine tree scarcely ever survives the loss of its foliage; when it has been entirely stripped of its needles it dies.

Many New Jersey towns have a right to be

proud of their trees; but the bagworm is there, and many of the larch and maple trees have suffered much from the ravages of these insects. There are also strong colonies established in New York City and Brooklyn. Although distribution is slow, owing to the fact that the females have no wings, the bagworm is spreading from tree to tree in these cities.

### THE BEASTLY BAGWORM

Until one has become familiar with these caterpillars, especially the species that feeds upon the evergreen trees, they are apt to escape one's notice,



Young bagworm crawling up a twig

since they belong to that interesting class of insects that are protected by their resemblance to their surroundings. The walking-stick, for instance, is an excellent example of what is termed *protective*



A colony of bagworms on a twig

*resemblance*. This curious insect so closely resembles a twig as to be readily mistaken for one. In the case of the bagworm, it is not the insect that resembles its surroundings, but rather the "cocoon"-like bag that it occupies, and decorates so cleverly with bits of foliage that one is likely to mistake it for a bunch of leaves or pine-needles, as the case might be.

There are several species of bagworms. Each species has its own individual way of decorating



its bags. The species that feeds upon the locust, maple, poplar, or willow trims its bag with pieces of leaves or stems, which it deliberately bites off for that purpose; and those that live on the pine or larch trees adorn their bags with the slender needles of those trees.

Bagworms are said to be omnivorous and voracious. According to the writer's observations, those in captivity are not omnivorous, but will eat only the leaves of the tree upon which they are found. Voracious they are, indeed. Their appetites never



Winged male and wingless female of bagworm moth

seem wholly satisfied until they are ready for the chrysalis state.

When first hatched, the caterpillar is no larger than a pinhead. It crawls about on its front feet, with its posterior end held straight up in the air. Immediately the tiny caterpillar begins to weave

for itself a bag. Later, as the caterpillar increases in size, it continues to enlarge its bag.

When feeding or crawling about, the caterpillar presents a ludicrous sight; only its head and front feet can be seen, the rest of the body remaining inside the bag, which it drags after it, or holds upright, in an awkward fashion, above its head.

At night, the bag makes a snug little cradle. By means of silken threads, the caterpillar suspends it from a twig, and, after closing the opening with silk, the insect is safely and comfortably housed for the night.

### BIOGRAPHY OF THE BAGWORM

The caterpillars molt four times. During each molting period, the bags hang suspended day and night. One might suppose that the instinct of protective resemblance was keener than the instinct of hunger in these insects. For it seems that after a molt, which means a fast of several days, the caterpillar first decorates its bag with fresh leaves, before satisfying its ravenous appetite.

After attaining their full growth, the bags are suspended from the trees, and the caterpillars retire within to pass through the mysteries of metamorphosis. The chrysalis, or pupa, state is not long. In about three weeks the male emerges from the lower end of his bag as a small, delicate-winged moth, and the wingless female pushes her way to the lower opening of her bag where she

awaits the visit of the male. After fertilization, she withdraws into her bag, and proceeds to fill the pupa case with tiny, pearl-colored eggs, carefully packing them with a soft yellow silk. When she



Bagworms clustered about the top of a sapling

has finished laying her eggs, she leaves her bag and drops to the ground, where she soon dies.

All winter the bags, full of innumerable eggs, hang upon the trees. The writer counted the eggs in four bags; one contained 591, another 512, another 502, and the last 69 eggs.

Fall and winter is an especially good time to fight the bagworms. Gather the "cocoon"-like bags



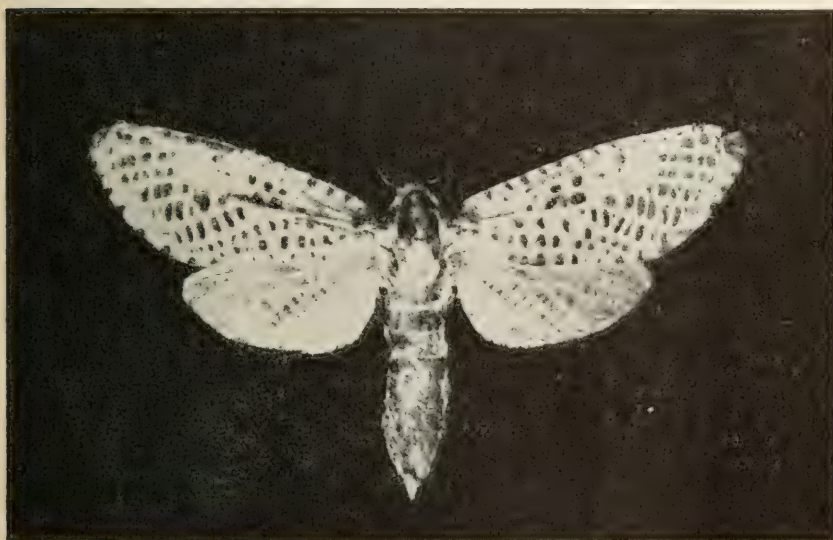
Pupa inside of bag, and eggs inside of pupa

and destroy them, and you will prevent these insects from becoming a dangerous pest.

Dr. L. O. Howard states that, when the bagworm occurs upon deciduous trees, it can be controlled by hand-picking the bags in winter; but when it affects the evergreens, the bags are more difficult to find, and therefore an arsenical spray is recom-

mended to be used in the spring, soon after the eggs are hatched.

One pound of the prepared paste of arsenate of lead to fifty gallons of water will prove fatal to the young larvæ, when used in spraying infested trees.



The leopard-moth (natural size)

### TREE-BORERS

In young orchards, gardens, and timber plantations the tree-borers are apt to be very destructive. They are difficult to combat, as the ordinary spraying operations do not reach them at all. Among the largest and most destructive of the tree-borers are the larvæ of the leopard- and goat-moths. These



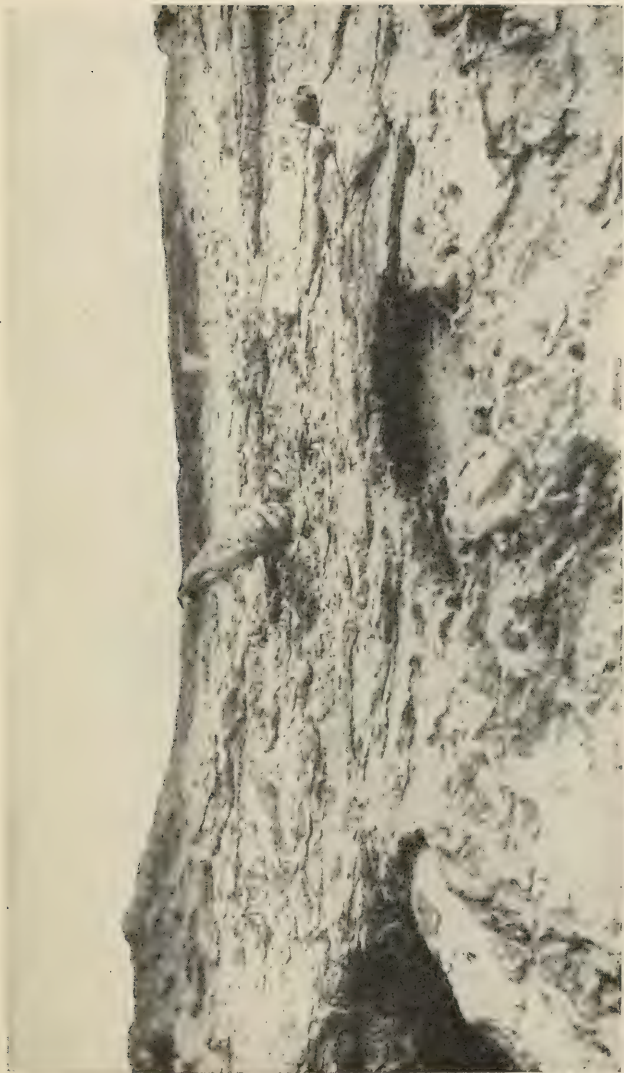
caterpillars are commonly called borers, because they bore into the wood and feed upon the very heart of the tree.

Like most of our deadly pests, the leopard- and goat-moths are natives of the Old World. Some time prior to the year 1879, they were introduced into the United States. Since then they have been steadily increasing in numbers until now they are well established in certain parts of the country, for instance, New Jersey, Connecticut, Staten Island, Long Island, New York, and Massachusetts.

### MORE LIFE HISTORIES

These moths belong to the same genus *Cassidæ*, and their life-history is similar. The larvæ of both species are indiscriminate feeders, attacking such shade trees as the elm, ash, beech, birch, walnut, oak, chestnut, poplar, alder, maple, mountain ash, tulip, aspen, willow, and among the orchard trees the pear, apple, and plum; also, such shrubs as the privet, lilac, and honeysuckle. The moths appear in July. During the day they remain motionless upon the trunks of trees; although in plain view, they are difficult to see, since their protective coloring conceals them.

The females lay their eggs in the cracks of the bark, near the ground, and occasionally on the roots of the tree. As many as 300 eggs have been counted in a mass, but it is believed that they often exceed this number.



A pupa skin sticking out of the trunk of a tree

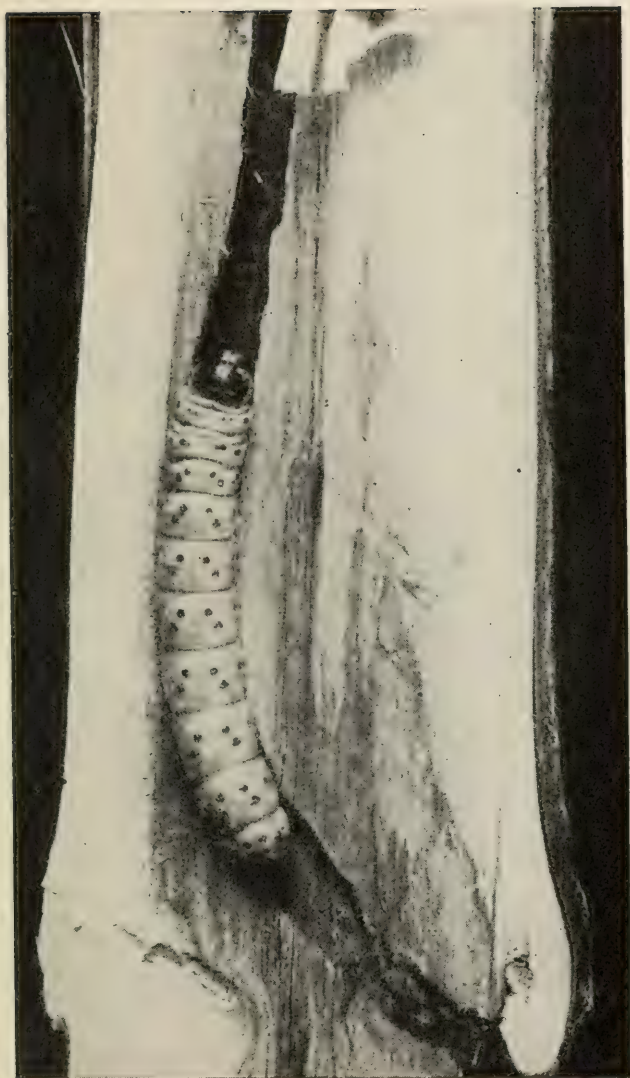
The young caterpillars soon hatch and penetrate the tree, burrowing long tunnels, which increase in diameter as the caterpillars increase in size. The full-grown larva of the leopard-moth attains the length of 2 inches, and the circumference of an inch, while the larva of the goat-moth grows to be 3 inches long.

The caterpillars do not always burrow lengthwise of the branch; frequently they girdle it, thus weakening the branch so much that it breaks off, especially during storms. L. O. Howard states that in 1893 the trees in Central Park, New York City, were so badly damaged by the borers that after every storm great quantities of limbs were broken off.

The caterpillars feed in summer, and rest during the winter months. About two years are required for them to reach their maximum growth. Then comes the pupal stage, which is passed near the opening of the tunnel. When metamorphosis is completed, the pupa works its way to the mouth of the tunnel, when the thin skin splits open and the moth escapes, leaving the empty pupa-skin protruding from the deserted tunnel.

Trees are often seriously injured before the borers are discovered. The signs that indicate their presence are the small holes in the trees, the oozing sap, and the empty pupa-skins sticking out of the trees.

These insects are so destructive that a single one can seriously damage a tree. Indeed, a single one will sometimes kill a tree.



The tree borer, or larva of the leopard-moth (natural size)

## THE DESTRUCTIVE GOAT-MOTH

The goat-moth has done great damage to the trees of Europe. Mr. W. J. Holland, in his book on moths, tells the following interesting story: "My friend, Dr. Ortman, entering my study while I was writing, relates that when he was a boy of eleven, living in his native village in Thuringia, his attention was called to a notice posted by the Burghermeister, offering a reward for information which would lead to the detection and punishment of the individuals who, by boring into the trunks of a certain fine avenue of birch trees, upon which the place prided itself, had caused great injury to them. Already the instincts of the naturalist had asserted themselves, and the prying eyes of the lad had found out the cause of the trouble. He went, accordingly, to the office of the Burghermeister, and informed him that he could tell him all about the injury to the trees.

"The official sat wide-mouthed and eager to hear. 'But you must assure me, before I tell you, that the reward you offer will surely be paid to me.' 'Yes, yes, my little man; do not be in doubt on that score. You shall certainly be paid.' 'Well then, Herr Burghermeister, the holes from which the sap is flowing were not made by boys who were after the birch-sap to make beer, but by the *weidenborer*' [the common German name for the *Cossus*]. A small explosion of official dignity followed. The act of the presumptuous boy



was reported to a stern parent, and the result was, in Yankee phrase, a 'licking,' which was certainly undeserved."



A broken branch, the result of a borer's girdling tunnel

### FIGHTING BORERS

Let us not be like the Burghermeister. Let us heed a timely warning, and examine our trees, and wherever the tell-tale holes are found, search for the deadly borer and destroy it, lest it continue to increase and work great havoc among the trees of this country.

It requires patience to fight the borers, for they are so well protected in their burrows inside the trees that they are difficult to reach.

The simplest method, however, is to insert into the holes a long, pliable wire, hooked at one end, and draw out the insect. Then, by means of a small glass syringe, inject into each hole one teaspoonful of carbon bisulphid. This is a deadly poison, and should be used with the greatest care against fire (smoking is dangerous when using this chemical). After the solution has been injected, securely close the holes with wax or putty. In case of badly infested trees, the safest way is to cut them down and burn them; thus destroying all larvæ and pupæ.

When it is desired to save a rare and valuable tree at any cost, consult an expert. Much can be done by the so-called "tree-doctor" to save a tree that seems to be doomed. Many trees in our city parks are evidences of his skilled labor. It is well to be warned, however, that many of the itinerant "tree doctors" are the worst quacks in the world.

Trees that were in such a condition that one would suppose that they were hardly worth atten-

tion, have been rescued and given back to man for many additional years of usefulness.

If all realized the great destructiveness of which these pests are capable, all would be on the lookout for them, and wage unending war. The method of destroying them is comparatively simple, but requires patience.

### FUNGIOUS DISEASES

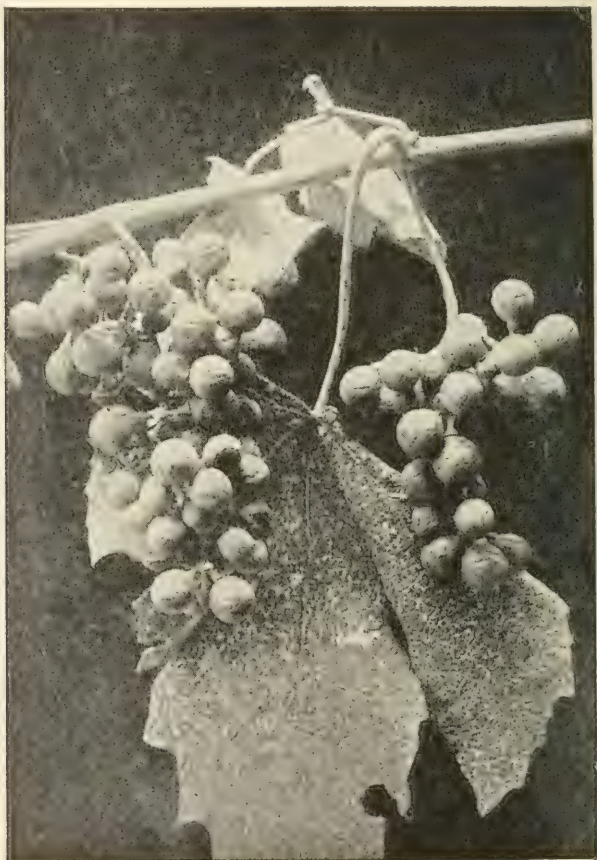
Many of the serious plant diseases are caused by fungi, which are simply microscopic, parasitic plants. The most important of these in the orchard are apple scab, brown rot, peach leaf-curl and sooty fungus.

Apple scab is the most serious fungous disease in apple orchards. Where there is much damp, muggy weather, it is apt to be troublesome. It attacks twigs, leaves, and fruit, making a black scab or, in very bad cases, a crack on the fruit. On leaves it begins as a yellowish spot, which gradually becomes brown. Spraying with lime-sulphur just after the petals fall and again three or four weeks after will usually keep it in check. In sections where it is serious, make another application before the blossoms open.

Brown rot attacks plums, peaches, and cherries, causing them to rot and shrivel up, producing the mummied fruits often seen on trees in winter. In moist seasons it may cause great loss. Spray with commercial lime-sulphur before the buds break.

Follow this with self-boiled lime-sulphur when the fruit in peaches and plums is the size of the end of one's thumb. Repeat every two weeks for bad cases, until three or four applications have been made.

Leaf-curl of peach causes the leaves to become



Grapes partly destroyed by black rot

thickened and distorted, and eventually to fall. It can usually be entirely controlled by spraying with lime-sulphur or bordeaux mixture before the buds swell.

Sooty fungus and fly-speck disease of apples are two allied diseases which attack the skin. They are just what the names suggest; do not penetrate much, but injure the appearance and sale of the fruit. They are easily controlled by the ordinary sprayings given apple orchards. It may sometimes be necessary to make an additional application of lime-sulphur the last of June or first part of July.

### A SUMMER'S PROGRAMME.

Preparedness and quick action are of the utmost consequence in dealing with all attacks of insects or disease in the garden. For this reason every gardener should have his plan of campaign fully outlined in advance, and should be constantly on the watch for possible attempts from the enemy. Here is a little programme showing about what to expect.

#### APRIL

The aphides, or green plant lice, and canker worms may be looked for in April. You will find them on the apple trees. If you notice the new leaves curling up, suspect the aphides at once, and spray with kerosene emulsion or whale-oil soap. The canker worms may be seen suspended from a thread attached to the limbs; spray with paris green.



## MAY

Look for the first appearance of the currant worm on currant and gooseberry bushes. It eats the leaves very quickly and comes in great numbers. Spray with paris green or hellebore. The hellebore may be mixed with flour and applied dry in the morning while the dew is on the leaves. Hellebore should always be used after the fruit has set, as it loses its poisonous qualities more quickly than paris green.

Look on the strawberry plants for the saw-fly. It eats holes in the leaves. Spray with paris green, or use hellebore dry for this pest.

Plant lice may be found on the pea vines this month. Spray with kerosene emulsion or whale-oil soap. Also watch for plant lice on fruit trees, and spray with kerosene emulsion or whale-oil soap.

The flea beetle appears on potatoes usually in May and should be treated with bordeaux mixture.

The cutworm comes in May and cuts down young vegetable plants and flowers. Dig around the plants until the worms are found, or protect the plants by strips of paper reaching an inch below the surface. Plant radishes; sometimes the cutworms will attack them first.

The bud-worm may be looked for in May eating into the buds of the apple trees. Use paris green and bordeaux mixture as the buds expand.

Use bordeaux mixture to prevent leaf-blight on pear trees.

Spray plum trees with paris green to prevent the work of curculios. Do not wait until the fruit drops. If these pests have already begun their work, it is a good plan to jar them from the trees every morning for a week or so. Do this by means of a long, heavy pole, the butt of which has been covered with burlap or some other means of protection, and thrusting it with as much force as possible against the trunk of the tree.

Hollyhocks suffer much from rust, which is apt to appear in May. Use bordeaux mixture frequently.

The insects mentioned in April also continue their ravages during May unless checked.

#### JUNE

Look for a second visitation from the currant worm.

Spray with paris green to kill the saw-fly on the berry bushes until after the fruit sets, when only hellebore should be used.

Spray the grape-vines in June with paris green and bordeaux mixture for various insects and diseases.

The striped beetle will appear on the melons; fight him with paris green mixed with bordeaux mixture, and use very freely and frequently. This pest must be stopped at the beginning.

#### JULY

Spray again in July for leaf-blight on berry bushes.

Anthracnose is a common grape disease which appears in July, and is identified by spotted leaves and cracking shoots. Spray with bordeaux mixture several times. Downy mildew also appears on grapes in July and causes the fruit to shrivel; bordeaux is also the remedy for this disease.

Celery rust appears in July, and the celery should be treated with bordeaux mixture once a week.

Plant lice will continue in evidence in the garden. Spray with kerosene emulsion. Use kerosene emulsion also on onions when dark-colored insects known as thrips are found on the leaves.

Continue paris green and bordeaux mixture on the potatoes.

If the horned worm, a large, disgusting green pest, with a horn-like projection, is found on the tomatoes, knock them into a pail with a little kerosene in the bottom.

Spray the apple trees with bordeaux mixture, and continue this for ten days until the fruit is nearly ripe. This will prevent bitter-rot, so often found in apples in the home garden and known by the bitter taste, and it will also prevent scab.

#### AUGUST

Most of the insect pests which appear in July continue their activities during August. The celery caterpillar also appears during this month, and should be treated with paris green. Continue to spray potatoes to prevent blight.

The squash borer appears in August. Cut open

the infested stem and destroy the borer. Afterward cover the injured part with earth. Trap squash bugs by placing shingles about the vines. The bugs will crawl under these shingles at night and may be destroyed early in the morning.

Spray tomatoes with paris green to kill the fruit worm, a large, greenish, striped pest, which bores into the fruit. If the fruit is nearly ripe it is better to pick them off by hand. For rot on tomatoes, spray with bordeaux mixture frequently.

### SPRAYING CALENDAR

For ready reference it is convenient to have all this information condensed and arranged in tabular form. In the following pages will be found such a calendar, prepared by several experts and edited with special care for the use of amateurs.

It should be said in this connection that the manufacturers of spraying machinery and the state experiment stations are always courteous and prompt to answer any inquiries addressed to them by mail. In case of doubt, it is always best to consult an expert, especially as it does not cost anything.

# INSECTS AND DISEASES, AND

## The formulas for insecticides and fungicides

What to Spray and What to Spray For	Spray With	Time of First Spraying
<b>APPLE—</b>		
<b>Bitter-Rot.....</b>	Bordeaux mixture.	First appearance of rot.
<b>Canker Worm</b>	Arsenate of lead, paris green.	On first appearance of worms.
<b>San José Scale</b>	Commercial lime-sulphur.	When the leaf buds begin to swell.
<b>Scab.....</b>	Self-boiled lime-sulphur or bordeaux mixture.	As the buds are swelling.
<b>Codlin-Moth..</b>	Arsenate of lead.	After the petals drop.
<b>ASPARAGUS—</b>		
<b>Beetle.....</b>	Arsenate of lead.	Early spring.
<b>Rust.....</b>	Bordeaux mixture.	After cutting crop.
<b>BLACKBERRY....</b>	Arsenate of lead, paris green.	
<b>CABBAGE AND CAULIFLOWER</b>	Pyrethrum.	On first appearance of worms.
<b>CELERY.....</b>	Bordeaux mixture.	On young seedlings.
<b>CHERRY—</b>		
<b>Aphis.....</b>	Kerosene emulsion.	At first appearance.
<b>San José Scale</b>	Commercial lime-sulphur.	Before buds open.
<b>Leaf-Spot ....</b>	Lime-sulphur.	Just before blossoms open.
<b>CUCUMBER—</b>		
<b>Anthracnose...</b>	Bordeaux mixture.	When plants begin to run.
<b>Downy Mildew</b>	Bordeaux mixture.	When plants begin to run.
<b>CURRENT—</b>		
<b>Leaf-Spot.....</b>	Bordeaux mixture.	As leaves are unfolding.
<b>Worm.....</b>	White hellebore.	When they first appear.
<b>GOOSEBERRY—</b>		
<b>Leaf-Spot.....</b>	Bordeaux mixture.	Before leaves start.
<b>Worm.....</b>	Same as for currants.	
<b>Mildew.....</b>	Potassium sulphide	When buds are breaking.



## METHODS OF CONTROL

referred to here will be found on pages 66 to 71.

Time of Second Spraying	Time of Third Spraying	Time of Fourth Spraying
One to two weeks later. Two or three days later if worms remain. If a bad case, repeat.	Two weeks later. Same as second.	
Just before the blossoms open.	As the blossoms fall.	Ten to fourteen days after they fall if necessary.
One month later.		
Ten days later.	Ten days later.	Ten days later.
Whenever worms are noticed. Repeat on seedlings.	Before or after transplanting.	Two weeks later.
Repeat as necessary.		
When fruit is free from calyx.	Two weeks later.	Two weeks later.
Two weeks later.	Two weeks later.	Two weeks later.
Ten days later.	Nine days later.	Eight days later.
Two weeks later. In three or four days	Two weeks later. Repeat three or four days later.	Three weeks later.
Two weeks later.	Two weeks later.	Three weeks later.
Repeat every ten days until fruit is gathered.		

# INSECTS AND DISEASES, AND

What to Spray and What to Spray For	Spray With	Time of First Spraying
<b>GRAPE—</b>		
<b>Anthracnose...</b>	Bordeaux mixture.	Just before buds open.
<b>Berry Moth...</b>	Arsenate of lead.	Before blossoms are ready to open.
<b>Downy or Pow- dery Mildew</b>	Bordeaux mixture.	Just before blossoming.
<b>Rot.....</b>	Bordeaux mixture.	Just before blossoming.
<b>MUSKMELON—</b>		
<b>Anthracnose...</b>	Bordeaux mixture.	When it begins to vine.
<b>Downy Mildew</b>	Bordeaux mixture.	July 25 to Aug. 1.
<b>Leaf-Blight ...</b>	Bordeaux mixture.	When plants begin to vine.
<b>PEACH—</b>		
<b>Leaf-Curl.....</b>	Commercial lime-sul- phur or bordeaux mixture.	In March or April, or both, to make dou- bly sure.
<b>Brown Rot....</b>	Self-boiled lime-sul- phur and arsenate of lead.	About time shucks are shedding from young fruit or on first ap- pearance.
<b>Scab.....</b>	Bordeaux mixture.	Just as buds begin to swell.
<b>San José Scale</b>	Commercial lime-sul- phur.	In late fall or early spring, or both if bad.
<b>PEAR—</b>		
<b>Leaf-Blight ...</b>	Bordeaux mixture.	Cut out the branches on first appearance on twigs.
<b>Psylla.....</b>	Kerosene emulsion or whale-oil soap.	In winter, use commer- cial lime-sulphur for eggs.
<b>PLUM—</b>		
<b>Curculio.....</b>	Arsenate of lead.	With starting of buds.
<b>Aphis.....</b>	Whale-oil soap.	On appearance of aphids.
<b>Shot-hole Fungus.....</b>	Self-boiled lime-sul- phur, bordeaux.	When leaves are half grown.
<b>Rot.....</b>	Bordeaux mixture.	As buds are swelling or on appearance.
<b>POTATO—</b>		
<b>Early Blight ..</b>	Bordeaux mixture.	When plants are 6 inches high.
<b>Late Blight....</b>	Bordeaux mixture.	As for early blight to July.
<b>Potato Beetle.</b>	Paris green.	When pest appears.

## METHODS OF CONTROL, continued

Time of Second Spraying	Time of Third Spraying	Time of Fourth Spraying
Just before blossoming. After blossoms have fallen. After fruit has set. Just after fruit has set.	After fruit has set. Ten days later.  Ten days later. Eight days later.	Ten days later.   Eight days later.
Two weeks later. Ten days later. Three weeks later.	Two weeks later. Nine days later. Three weeks later.	Two weeks later. Eight days later. Two weeks later.
Two or three weeks later.	About one month before fruit ripens. Omit arsenate of lead.	
After fruit has set.	Repeat later when fruit is about half grown.	
After blossoms fall.	Repeat at intervals of three to seven days.	
Just after blossoms drop.	Five days later.	
Three weeks later.	Three weeks later if necessary.	
Just after calyx drops.	Three or four weeks later	As fruit begins to color.
Seven to ten days later.	Two weeks later.	Two weeks later if necessary.
July 15 to 20.	Two weeks later.	Ten days later.
Repeat if necessary.		

# INSECTS AND DISEASES, AND

What to Spray and What to Spray For	Spray With	Time of First Spraying
<b>RASPBERRY—</b> <b>Anthracnose...</b>	Bordeaux mixture.	Before leaves open.
<b>Saw-Fly .....</b>	Paris green and arsenate of lead or hellebore.	When pest first appears.
<b>Leaf-Spot.....</b>	Bordeaux mixture.	When leaves are half grown.
<b>ROSE—</b> <b>Leaf-Spot.....</b>	Bordeaux mixture.	On first appearance of fungus.
<b>Slug.....</b>	Hellebore.	On appearance of slugs
<b>STRAWBERRY—</b> <b>Leaf-Spot.....</b>	Sulphate of iron, bordeaux mixture.	Soon after growth begins.
<b>SQUASH—</b> <b>Aphis.....</b>	Kerosene emulsion.	Spray under side of leaves.
<b>Lady Beetle...</b>	Arsenate of lead.	As soon as pest appears.
<b>TOMATO—</b> <b>Anthracnose...</b>	Bordeaux mixture.	Soon after fruit begins to set.
<b>Leaf-Blight ...</b>	Bordeaux mixture.	Three weeks after transplanting.
<b>White Fly.....</b>	Soap and water.	Spray under side of leaves thoroughly.

## METHODS OF CONTROL, continued

Time of Second Spraying	Time of Third Spraying	Time of Fourth Spraying
When new canes are 6 to 8 inches high. Repeat in three or four days.	Ten days later.	Ten days later.
Two weeks later.	Two weeks later.	
Two to three weeks later. Repeat if necessary.	Repeat if necessary.	
Make three or four sprayings during sea- son.	The following spring spray just before blossoming and again ten days later.	
Three weeks later.		
Three weeks later.	Three weeks later.	
Three weeks later.	Three weeks later.	Three weeks later.



## APPENDIX

For the convenience of the reader, we have grouped under one heading the various formulas for making the common solutions used in spraying, some of which have already been given in the foregoing pages. They are all of proved value, and recommended by experts.

### INSECTICIDES

The insects infesting cultivated plants are divided into two general classes,—chewing insects and sucking insects,—and the remedies and exterminators are made to suit the kind of insect to be attacked.

#### FOR CHEWING INSECTS

*Arsenic* in the form of paris green or arsenate of lead. The latter, arsenate of lead, is so much preferable to paris green that formulas for it only are given. Paris green, if used in too large a quantity, will burn the plants; arsenate of lead will not, even though used in large quantities, and it remains in suspension much longer than paris green. It is also sold under such trade names as “Disparene.” Arsenate of lead is white, and comes in paste form. It is usually used at the rate of six ounces to five

gallons of water, but can be used at the rate of one pound to five gallons.

*Resin Soap*, used to make arsenical poisons stick to smooth surfaces, like cabbage. Five pounds of pulverized resin, one pound of concentrated lye, one pint of fish- or any animal oil, five gallons of water.

To make, put the resin and oil and a gallon of water in an iron kettle and heat; when the resin has dissolved, add the lye, stirring the solution; add the balance of the water and boil the whole for two hours, or until the solution, when put in cold water, will make a clear, amber-colored liquid. The solution, when boiling, should be kept up to five gallons by adding water to make up for loss by evaporation. To use, dilute one pint of the soap with sixteen pints of water, and add three pints of milk of lime or whitewash, and one-fourth pound of paris green, or it can be diluted with bordeaux mixture.

*Poisoned Bran Mash*. One ounce of white arsenic, one to two ounces of brown sugar, six to ten ounces of bran.

Mix these together, and add enough water to make a wet but not sloppy mash. This is used as a poison bait.

*Hellebore*, an internal poison for insects, but not to man. It is used in place of paris green or arsenate of lead where there is danger of the poison remaining on the parts of plants to be eaten. Dust dry on the leaves, especially the under side, when the dew is

on, or sprinkle the leaves to insure its sticking. As a solution it can be sprayed on, using one ounce to one to three gallons of water.

#### FOR SUCKING INSECTS

*Kerosene Emulsion.* One-half pound of hard soap, two gallons of kerosene, one gallon of water.

Shave up the soap and dissolve it in the water, which should boil. Remove from the stove and, while still boiling, add the kerosene and thoroughly churn it. The best way to do this is by means of a bucket spray-pump. Churn until it becomes a soft, butter-like mass. This is a stock solution; to use, dilute with ten to twelve parts of water. For scale insects in winter, stock solution can be used without dilution.

*Whale-oil Soap.* (a) As a winter spray against scale insects, use two pounds to one gallon of water. Trunk and branches can be painted by hand in summer, but this strength will injure the leaves. Only one application of this strength should be used in a season.

(b) One pound to one gallon of water.

(c) One pound to eight to ten gallons of water.

*Pyrethrum, or Insect Powder.* Burn in the house to kill fleas, flies, mosquitos, and cockroaches. As it deteriorates rapidly, it must be kept in a tight can. To spray, use one-fifth of an ounce (100 grains) in two gallons of hot water.

*Sulphur.* (a) One ounce to one gallon of water.

(b) Place the flowers of sulphur on steam or hot-water pipes.

(c) Dust on leaves.

(d) Flowers of sulphur, one part; lime twenty to forty parts.

*Tobacco.* (a) Dust. Sprinkle over cucurbits to drive away the striped beetle. Work it in the ground about plants infested with root-lice. In case of a tree, use one and one-half to two pounds.

(b) Stems. Make a decoction, using one pound to two gallons of hot water. Let it stand for several hours in a tight vessel. It can be greatly improved by adding one ounce of pyrethrum. Dilute to use with three to five parts of water.

(c) Fumigate with stems or with one of the tobacco extracts now on the market. If stems are used, care must be taken not to burn the foliage by too strong a smoke.

*Lime-Sulphur Wash.* This is being recommended and used by horticulturists in place of bordeaux mixture for the treatment of plant diseases, such as apple scab, as well as for the San José scale, for which it was first used. Commercial lime-sulphur wash ready to use, except to dilute with water, according to the directions, can be bought, and is much handier to use than home-boiled. A home-boiled concentrated solution can be made as follows: One pound of lime, two and one-fourth pounds of sulphur, one gallon of water.

Use an iron kettle, slake the lime in a little water, and add the sulphur when the lime begins to slake. Sift the sulphur in, and be sure there are no lumps. Boil hard for over an hour, or until the sulphur is

dissolved, but it must boil for forty-five minutes, at least. Add water as necessary, and, when about finished, dilute with water, preferably hot, to make one gallon. This should have a specific gravity of 1.30.

(a) For winter, spray for San José scale. Dilute with nine parts of water (or to 1.03 specific gravity).

(b) For spring, spray for apple, pear, and quince, to prevent scab. Dilute with twenty to thirty parts of water (or, to 1.01 to 1.015 specific gravity).

(c) For summer, spray for apple, pear, and quince. Dilute one part of the stock solution with thirty to forty parts of water.

(d) For peaches, plums, and cherries, for the brown rot, dilute with fifty to sixty parts of water (or 1.006 specific gravity).

*Carbolic Soap.* Two pounds of soft soap; dilute this with rain-water to the consistency of paint, and add one ounce of crude carbolic acid.

## FUNGICIDES

*Copper Sulphate.* For use on dormant trees, dissolve three ounces in five gallons of water.

*Ammoniacal Copper Carbonate.* Dissolve five ounces of copper carbonate in three pints of ammonia (26° Beaumé); dilute for use with forty-five gallons of water. The stock solution will keep indefinitely if kept in a tightly corked bottle. This will not stain the plants, as will bordeaux mixture.

*Potassium Sulphide, or Liver of Sulphur.* Dis-



solve one-half ounce in one gallon of water. This loses strength with age; mix it fresh.

*Formalin.* For potato scab, one pint to fifteen gallons of water.

*Corrosive Sublimate.* For potato scab, two ounces to two gallons of water.

*Bordeaux Mixture.* In five gallons of water, dissolve five ounces of copper sulphate by hanging in a bag in the top of the tub, and five and one-half ounces of good stone lime, and stir thoroughly. Strain into sprayer and add, when an insecticide is wanted as well, three to six ounces of arsenate of lead.

*Iron Sulphate.* For use on dormant plants only. Dissolve in three quarts of hot water as much iron sulphate as the water will hold, then add one ounce of sulphuric acid.

## SPRAYING MEMORANDA

Insect Pest	Spray Mix- ture Used	When First Sprayed	Date of Second Spraying	What Result

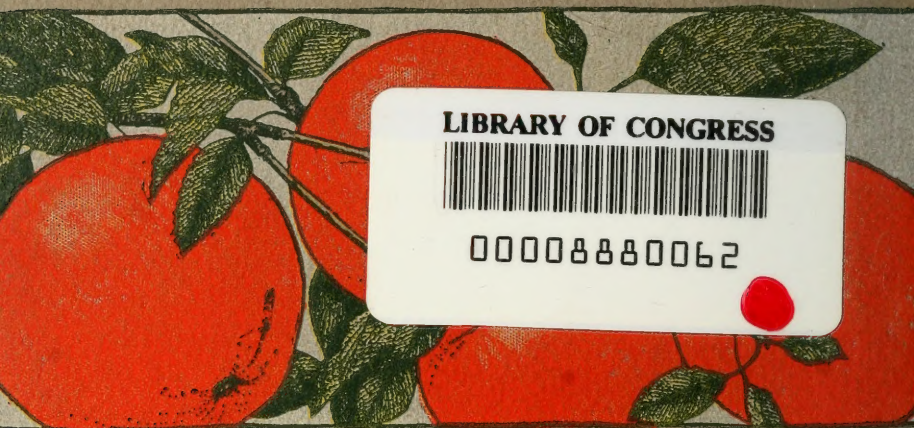




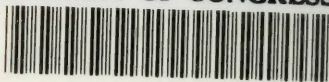




# FIGHTING GARDEN PESTS



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